

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

MODULE TEST #2

TRIMESTER 1, 2020 / 2021

ECE3296 – DIGITAL IMAGE AND VIDEO PROCESSING (CE)

8 OCTOBER 2020
8.30 p.m. - 9.30 p.m.
(1 Hour)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **3** printed pages with **FIVE** questions only.
2. Answer **ALL** questions.
3. Write your answers in the Answer Booklet.

(1) Explain how arithmetic operations below can be used to enhance an image:

- Image addition
- Image subtraction
- Image multiplication
- Image division

[8 marks]

(2) By using symmetric padding, apply an averaging filter to smooth the 4×3 image in Figure 1. Round your answer to the nearest integer.

| | | |
|-----|-----|-----|
| 47 | 46 | 47 |
| 48 | 48 | 47 |
| 200 | 201 | 202 |
| 199 | 200 | 199 |

Figure 1

[4 marks]

(3) The output of all derivative filters are edge images instead of sharpened images. To obtain the sharpened image, the edge image can be added back to the original image. Alternatively, this can be done directly by modifying the filter mask. For the Mexican Hat filter mask shown in Figure 2, modify the filter coefficients so that it will output sharpened images directly.

| | | | | | |
|----------------|----|----|----|----|----|
| | 0 | 0 | -1 | 0 | 0 |
| | 0 | -1 | -2 | -1 | 0 |
| $\frac{1}{25}$ | -1 | -2 | 16 | -2 | -1 |
| | 0 | -1 | -2 | -1 | 0 |
| | 0 | 0 | -1 | 0 | 0 |

Figure 2

[3 marks]

(4) (i) Briefly describe frequency domain filtering. [3 marks]

(ii) Figure 3 shows an image and its frequency spectrum. By referring to the color-coded circles in the frequency spectrum, explain how the following filters operate in the frequency domain:

- Low-pass filter
- High-pass filter
- Notch filter

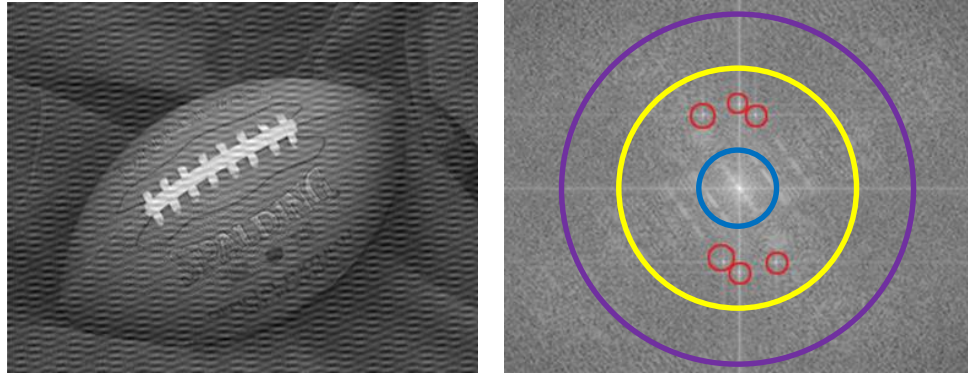


Figure 3

[6 marks]

(5) Briefly describe the three methods below for estimating the degradation function in image restoration application:

- Estimation by observation
- Estimation by experimentation
- Estimation by system modeling

[6 marks]

End of Paper